According to the present invention, failure in a power supply line connected to an output terminal of a rectifier of an alternator is detected. Upon detection of a failure in this power supply line, power generation is suppressed for a predetermined period that is longer than the time constant of a field winding of the alternator.

When a high voltage pulse that is higher than a predetermined regulated voltage and exceeds a predetermined voltage that is lower than the withstand voltage of a rectifier built into an alternator appears at an output terminal of an alternator, this high voltage pulse is detected to discriminate a first condition where a single high voltage pulse is generated when an electrical load connected to the power supply line is cut off and a second condition where a high voltage pulse is repeatedly and frequently generated when a failure occurs in a power supply line or in a peripheral area. When the second condition is discriminated, power generation suppression control of the alternator is conducted.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description made with reference to the accompanying drawings. In the drawings:

Fig. 1 is an electric wiring diagram showing an alternator for a vehicle according to a first embodiment of the present invention;

Fig. 2 is an electric wiring diagram showing a first modification of the first embodiment;

Fig. 3 is an electric wiring diagram showing a second modification of the first embodiment;

Fig. 4 is an electric wiring diagram showing a third modification of the first embodiment;

Fig. 5 is an electric wiring diagram showing a fourth modification of the first embodiment;

Fig. 6 is an electric wiring diagram showing a fifth modification of the first embodiment;

Fig. 7 is a characteristic diagram showing temperature rise of a Zener diode forming a full-ware rectifier in the first embodiment and its modifications;

Fig. 8 is an electric wiring diagram showing an alternator for a vehicle according to a second embodiment of the present invention;

Fig. 9 is a circuit diagram showing a high voltage pulse detecting circuit in the second embodiment;

Fig. 10 is a timing diagram showing signal waveforms inputted or outputted to or from each section of a voltage control circuit in the second embodiment when a high voltage pulse is generated once;

Fig. 11 is a timing diagram showing signal waveforms inputted or outputted to or from each section of the voltage control circuit in the second embodiment when the high voltage pulses are generated frequently;

Fig. 12 is a circuit diagram showing a pulse counting

circuit in the second embodiment;

Fig. 13 is a timing diagram showing signal waveforms inputted or outputted to or from each section of the pulse counting circuit in the second embodiment;

Fig. 14 is a circuit diagram showing a high voltage pulse detecting circuit included in a voltage regulator of an alternator for a vehicle according to a third embodiment of the present invention;

Fig. 15 is a timing diagram showing signal waveforms inputted or outputted to or from each section of the high voltage pulse detecting circuit in the third embodiment;

Fig. 16 is a timing diagram showing comparison of signal waveforms inputted or outputted to or from each section of the high voltage pulse detecting circuit of Fig. 9;

Fig. 17 is a circuit diagram showing a high voltage pulse detecting circuit included in a voltage regulator of an alternator for a vehicle according to a fourth embodiment of the present invention;

Fig. 18 is a timing diagram showing signal waveforms inputted to each section of the high voltage pulse detecting circuit in the fourth embodiment;

Fig. 19 is a timing diagram showing signal waveforms inputted to each section of the high voltage pulse detecting circuit in the fourth embodiment;

Fig. 20 is a circuit diagram showing a charging system using an alternator for a vehicle according to a fifth embodiment of the present invention;